AD-A173 228 SEMICONDUCTOR/SOLID ELECTROLYTE JUNCTIONS FOR OPTICAL INFORMATION STORAGE(U) ELTRON RESEARCH INC AURORA IL A F SAMMELLS 14 SEP 86 N00014-84-C-0723 1/1

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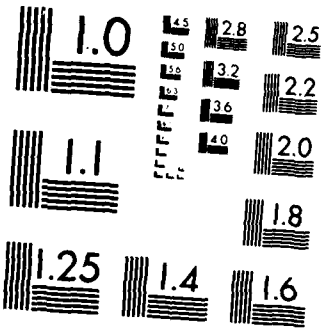

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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Solid-state electrochromic cells, n-TiO_2, n-CdS, heptyl viologen, lutecium diphthalocyanine, poly(Amps).

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The program was directed towards characterization of electrode and photoelectrode solid-state junctions with solid polymer electrolytes (SPEs) possessing incorporated electrochromic materials. Excellent electrochemical reversibility and corresponding electrochromic phenomena were found for cells utilizing lutecium diphthalocyanine and heptyl viologen as incorporated electrochromic materials.

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FINAL REPORT SUMMARY ONR N00014-84-C-0723

Solid-state electrochromic cells of the general configuration:

Lutecium Diphthalocyanine on SnO_2 cond. glass	Poly(Amps) + SE	Nafion 117	Poly(Amps) + $CeCl_3$	SnO_2 cond. glass

were prepared using the supporting electrolytes (SEs) 0.1M Na_2SO_4 and 0.1M KCl. Upon subjecting the cell to anodic and cathodic voltage scans, up to four distinct color changes were observed varying from red (at anodic potentials) to violet (at cathodic potentials). Formation of the violet lutecium diphthalocyanine reduction product was not found to be contingent upon the absence of alkali cations as reported by others.

For the electrochromic cell:

SnO_2 glass	Poly(Amps) + HV^{2+} + $NaPF_6$	Nafion 117	Poly(Amps) + $CeCl_3$ + $NaPF_6$	SnO_2 glass

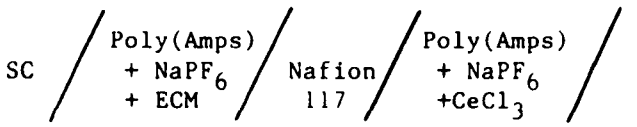
in which the heptyl viologen (HV^{2+}) working electrode compartment was subjected to a cathodic scan, two distinct reduction peaks were observed at respectively -1.74 and -1.90V versus the $CeCl_3/SnO_2$ reference/counter electrode. This corresponded to the formation of respectively, the radical and diradical cation species of HV^{2+}. This electrochromic cell was found to be highly electrochemically reversible as monitored by a He/Ne laser beam (583nm) transmitted through the bulk of this semi-transparent thin film solid-state cell.

The dependency of n-TiO_2 flatband potential (V_{fb}) for cells of the general configuration: n-TiO_2/Nafion 117, Redox species/SnO_2 conducting glass, was systematically studied for the redox species $Ru(bpy)_3^{2+}$, $Fe(bpy)_3^{2+}$ and $Ru(NH_3)_6^{3+}$ as a function of their concentration within the polymer. A linear relationship V_{fb} = M (1/concentration) + b was found to hold for all cells. The slope (M) was found dependent upon metal complex used and its oxidation state. The sensitivity of the measured n-TiO_2 flatband potential to its immediate chemical environment at its interface with the redox polymer can be a strategy pursued for chemical detection.

Solid-state photoelectrochromic cells possesing the general configuration:

SC	Poly(Amps) + $NaPF_6$ + ECM	Nafion 117	Poly(Amps) +$NaPF_6$ +$CeCl_3$	SnO_2 glass

Solid-state photoelectrochromic cells possessing the general configuration:



where SC = n-TiO_2 or n-CdS and ECM = HV^{2+} or $LuH(Pc)_2$ were prepared. SPE/SC junctions containing dispersed HC^{2+} behaved in a somewhat analogous manner to liquid junction PEC cells. Those cells prepared with $LuH(Pc)_2$ directly deposited onto the semiconductor surface had these photoelectrochemical properties dictated by the SC/$LuH(Pc)_2$ solid-state junction rather than by SPE redox properties.

TECHNICAL REPORTS SUBMITTED TO ONR DURING THIS CONTRACT (N00014-84-C-0723)

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0001 AA	November 15, 1984
0001 AB	January 15, 1985
0001 AC	March 15, 1985
0001 AD	May 15, 1985
0001 AE	July 15, 1985
0001 AF	September 15, 1985
0001 AG	January 15, 1986
0001 AH	May 15, 1986
0001 AJ	September 14, 1986

JOURNAL ARTICLES EMANATING FROM THIS CONTRACT:

S. K. Schmidt, R. L. Cook and A. F. Sammells, "Semiconductor Redox Polymer Detector Junctions," J. Electrochem. Soc., 133, 1617 (1986).

A. F. Sammells and N. U. Pujare, "Electrochromic Effects on Heptylviologen Incorporated Within a Solid Polymer Electrolyte Cell," J. Electrochem. Soc., 133, 1270 (1986).

A. F. Sammells and N. U. Pujare, "Solid-State Electrochromic Cell Using Lutecium Diphthalocyanine," J. Electrochem. Soc., 133, 1065 (1986).

R. L. Cook and A. F. Sammells, "Investigation of Photoelectrode Redox Polymer Junctions," J. Electrochem. Soc., 132, 2429 (1985).

A. F. Sammells and S. K. Schmidt, "A Two-Photoelectrode Solid-State Photoelectrochemical Cell," J. Electrochem. Soc., 132, 520 (1985).

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